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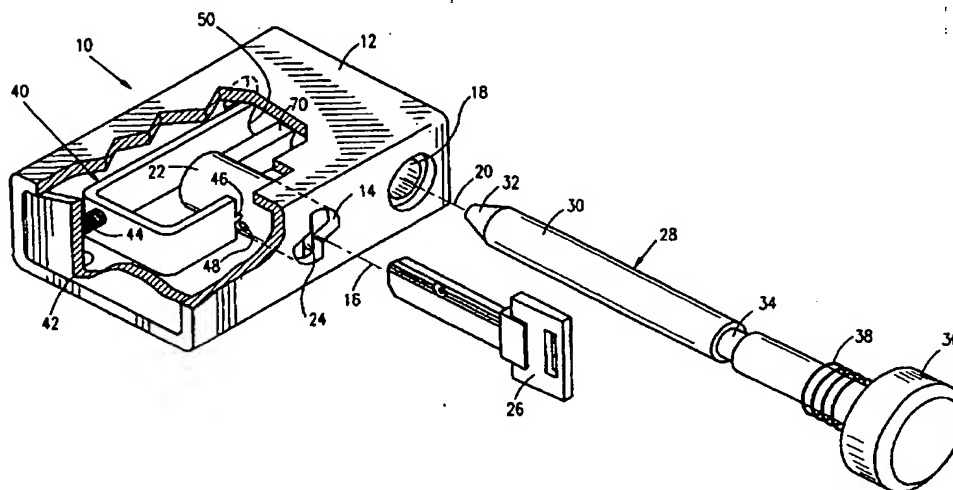
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With amended claims.

(54) Title: IMPROVED LOCK HOUSING



(57) Abstract

Lock apparatus (10) comprising a lock body (12) having a first elongate bore (14) extending along a first longitudinal axis (16) and a second elongate bore (18) extending along a second longitudinal axis (20), a tumbler (22) disposed within said first elongate bore (14) and arranged for rotation about said first longitudinal axis (16), said tumbler (22) being formed with a hole (48), a locking bolt (28) disposed in said second elongate bore (18) and arranged for sliding motion substantially along said second longitudinal axis (20) into an unlocked orientation and a tumbler rotation preventer (40) biased against a surface (42) in said lock body (12) and lockingly engageable with said tumbler (22), said tumbler rotation preventer (40) comprising a protruding member (46), such that in said unlocked orientation said protruding member (46) is lockingly engaged with said hole (48).

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IMPROVED LOCK HOUSING

The present invention relates to locks generally, and particularly to locks wherein turning of a key controls passage of a locking bolt through the lock.

Various types of locks are known in the art that operate with a key which turns a tumbler to control passage of a locking bolt through the lock. For example, in a padlock, there is generally a tongue that lockingly engage a locking bolt. Turning a key releases the tongue and allows moving or completely removing the locking bolt. Often the key rotates a lock cylinder having a tumbler with spring loaded pins, as is well known in the art.

Normally these types of locks are meant to safeguard belongings, such as a vehicle, wherein the locking bolt denies access or entry to such belongings, such as preventing movement of a gear shift lever, for example. A problem associated with such locks is that after removing the locking bolt, the key can be removed from the lock. This means that a negligent person can walk away from the lock with key in hand, and yet the locking bolt is not in its proper place, i.e., in locking engagement inside the lock and protecting the belongings.

There are padlocks with shackles equipped with mechanisms that prevent removal of the key when the shackle is not locked in place. Austrian Patent 31 08 606 describes a padlock with a lock housing and an essentially U-shaped shackle movable therein having two arms of different lengths. When the shackle is opened, the longer leg remains in the padlock body to operate a mechanism that blocks removal of the key. However, in this padlock, the operation of the blocking mechanism requires that the shackle at least partially remain in the lock housing, and so the device is not applicable for locks wherein it

is desired to completely remove the shackle from the lock.

German Patent 1,939,011 also describes a padlock with a mechanism for blocking removal of the key from the lock housing. However, this mechanism is also limited to a lock wherein the shackle is not completely removable from the lock housing.

Israel Patent 102153, issued to Applicant, describes a padlock with a locking mechanism actuated by a key-operated cylinder. The lock housing has a pair of bores for receiving therein a pair of legs of a shackle. The key can be removed from the cylinder only in a first orientation wherein the locking mechanism extends into the shackle receiving bores. In this padlock, the shackle is completely removable from the lock housing. The padlock requires a pair of blocking elements to prevent the locking mechanism from being in the first orientation except when the shackle is locked in the shackle receiving bores. It is also an essential feature of the device that the lock mechanism be actuated by rotation of the cylinder.

The present invention seeks to provide an improved lock wherein the key cannot be removed therefrom unless the locking bolt is properly lockingly engaged in the lock. Unlike the prior art, the locking mechanism that prevents removal of the key is not operated by rotation of a key-operated tumbler, but rather selectively engages the locking pin and the tumbler and prevents rotation of the tumbler if the locking bolt is not in place. The tumbler is prevented from rotating at an angular orientation that precludes removal of the key therefrom. Further, unlike the prior art, the present invention does not require blocking elements to negate the action of the locking mechanism when the locking bolt is in place. The lock of the present invention is particularly useful for locks equipped with a single locking

bolt, although it may be adapted for padlocks with double leg shackles as well.

There is thus provided in accordance with a preferred embodiment of the present invention, lock apparatus including a lock body having a first elongate bore extending along a first longitudinal axis and a second elongate bore extending along a second longitudinal axis, a tumbler disposed within the first elongate bore and arranged for rotation about the first longitudinal axis, the tumbler being formed with a hole, a locking bolt disposed in the second elongate bore and arranged for sliding motion substantially along the second longitudinal axis into an unlocked orientation, and a tumbler rotation preventer biased against a surface in the lock body and lockingly engageable with the tumbler, the tumbler rotation preventer including a protruding member, such that in the unlocked orientation the protruding member is lockingly engaged with the hole.

In accordance with a preferred embodiment of the present invention, if the locking bolt is not in the unlocked orientation, a portion of the locking bolt is biased against the tumbler rotation preventer, thereby moving the tumbler rotation preventer out of locking engagement with the tumbler.

Additionally in accordance with a preferred embodiment of the present invention, the tumbler is rotatable by means of a key inserted therein, and the key cannot be removed from the tumbler when the tumbler rotation preventer is lockingly engaged with the tumbler.

Further in accordance with a preferred embodiment of the present invention, lock apparatus also includes a plurality of body pin assemblies disposed in a plurality of body pin bores located within the lock body and communicating with the first elongate bore, a plurality of tumbler pin assemblies disposed in a plurality of tumbler pin bores located within the tumbler and communi-

cating with the first elongate bore, the plurality of tumbler pin assemblies being arranged such that upon suitable rotation of the tumbler in the first elongate bore, each of the tumbler pin assemblies is aligned coaxially with a corresponding one of the body pin assemblies, the key being removable from the tumbler only when each of the tumbler pin assemblies is aligned coaxially with a corresponding one of the body pin assemblies, and the tumbler rotation preventer lockingly engages the tumbler at a rotational orientation thereof such that each of the tumbler pin assemblies is not aligned coaxially with a corresponding one of the body pin assemblies.

Preferably the tumbler rotation preventer includes an end adapted to be biased against a portion of the locking bolt, the end being complementarily shaped to fit a shape of the portion of the locking bolt.

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

Fig. 1 is a simplified pictorial, partially cutaway, partially exploded illustration of lock apparatus constructed and operative in accordance with a preferred embodiment of the present invention;

Figs. 2 and 3 are simplified, partially sectional, front view illustrations of a portion of lock apparatus of Fig. 1, respectively before and after engagement of a protruding member of a tumbler rotation preventer with a hole formed in a tumbler;

Fig. 4 is a partially exploded, partially sectional, top view illustration of lock apparatus of Fig. 1, with a locking bolt in an unlocked orientation relative to a lock body, and a key retained inside the lock body;

Fig. 5 is a partially sectional, top view

illustration of lock apparatus of Fig. 1, with the locking bolt partially inserted into the lock body, and the key retained inside the lock body; and

Fig. 6 is a partially exploded, partially sectional, top view illustration of lock apparatus of Fig. 1, with the locking bolt in a fully locked orientation and the key removed from the lock body.

Reference is now made to Fig. 1 which illustrates lock apparatus 10 constructed and operative in accordance with a preferred embodiment of the present invention. It is noted that Fig. 1 is a simplified illustration that shows only those elements of lock apparatus 10 which are essential for understanding the present invention.

Lock apparatus 10 preferably includes a lock body 12 having a first elongate bore 14 extending along a first longitudinal axis 16 and a second elongate bore 18 extending along a second longitudinal axis 20.

A tumbler 22 is preferably disposed within first elongate bore 14 and is arranged for rotation about first longitudinal axis 16. Tumbler 22 preferably has a keyway 24 formed therein for inserting therein a key 26.

A locking bolt 28, preferably made of a hardened steel, may be disposed in second elongate bore 18. Locking bolt 28 preferably includes a generally cylindrical shank 30 with a tapered end 32. A notch 34 is preferably formed in shank 30 at a location between tapered end 32 and a head portion 36. A biasing element, such as a spring 38, is preferably disposed on shank 30 adjacent head portion 36. Locking bolt 28 is preferably arranged for sliding motion substantially along second longitudinal axis 20.

Lock apparatus 10 preferably includes a tumbler rotation preventer 40 which may be biased against a surface 42 in lock body 12 by means of a biasing device, such as a spring 44. In the illustrated embodiment,

tumbler rotation preventer 40 is preferably constructed of a bent or formed hardened metal strip that includes a protruding member 46 which is lockingly engageable with a hole 48 formed in tumbler 22. Tumbler rotation preventer 40 also preferably includes an end 50 adapted to be biased against a portion of locking bolt 28. As seen in Fig. 1, end 50 is preferably complementarily shaped to fit the contour of the outer periphery of locking bolt 28.

For the sake of clarity, Fig. 1 illustrates lock apparatus 10 in a simplified exploded view, and protruding member 46 and hole 48 are not shown in an operative orientation. The alignment of protruding member 46 with hole 48 is illustrated and described with reference to Figs. 2 and 3.

Reference is now made to Figs. 2 and 3 which illustrate engagement of protruding member 46 with hole 48. As seen in Fig. 2, lock apparatus 10 preferably includes a plurality of body pin assemblies 52 disposed in a plurality of body pin bores 54 located within lock body 12 and which communicate with first elongate bore 14. A plurality of tumbler pin assemblies 56 are preferably disposed in a plurality of tumbler pin bores 58 located within tumbler 22 and communicate with first elongate bore 14. Tumbler pin assemblies 56 are preferably arranged such that upon suitable rotation of tumbler 22 in first elongate bore 14, each tumbler pin assembly 56 is aligned coaxially with a corresponding body pin assembly 52.

Key 26 is removable from keyway 24 of tumbler 22 only when each tumbler pin assembly 56 is aligned coaxially with a corresponding body pin assembly 52, at which alignment each tumbler pin assembly 56 is free to extend into a corresponding body pin bore 54 and push against a corresponding body pin assembly 52, thereby allowing removal of key 26.

In the orientation of Fig. 2, each tumbler pin assembly 56 is aligned coaxially with a corresponding body pin assembly 52 and key 26 may be removed from tumbler 22. Hole 48 is angularly offset from the horizontal by an angle 60.

In the orientation of Fig. 3, tumbler 22 has been rotated in the direction of an arrow 62 by an amount equal to angle 60 and each tumbler pin assembly 56 is now misaligned coaxially with a corresponding body pin assembly 52. Hole 48 has been brought into alignment with protruding member 46. Spring 44 urges protruding member 46 in the direction of an arrow 64 so that tumbler rotation preventer 40 lockingly engages tumbler 22 and substantially prevents rotation thereof. In the orientation of Fig. 3, key 26 cannot be removed from tumbler 22 because each tumbler pin assembly 56 cannot extend into a corresponding body pin bore 54.

Reference is now made to Fig. 4 which illustrates locking bolt 28 in an unlocked orientation relative to lock body 12. Spring 44 is extended so that tumbler rotation preventer 40 is engaged with hole 48 of tumbler 22 and key 26 is retained inside lock body 12. The orientation of Fig. 4, which corresponds to that shown in Fig. 3, is an unlocked orientation. An unlocked orientation may be attained by completely removing locking bolt 28 from lock body 12, as shown in Fig. 4. Additionally, an unlocked orientation may be attained with locking bolt 28 partially inserted into lock body 12, as long as tapered end 32 does not sufficiently push tumbler rotation preventer 40 in the direction of an arrow 66, so as to dislodge protruding member 46 from hole 48.

Reference is now made to Fig. 5 which illustrates locking bolt 28 partially inserted into lock body 12. It is seen that shank 30 of locking bolt 28 has pushed tumbler rotation preventer 40 in the direction of arrow 66, so as to dislodge protruding member 46 from

hole 48. Locking apparatus 10 preferably includes a locking tongue 70 which is arranged for selectable locking engagement with locking bolt 28. Locking tongue 70 is actuated by rotation of tumbler 22, as is well known in the art. In the orientation of Fig. 5, locking tongue 70 contacts shank 30 and key 26 cannot be removed from lock body 12.

Reference is now made to Fig. 6 which illustrates locking bolt 28 fully inserted into lock body 12. It is seen that locking tongue 70 now contacts shank 30 at notch 34. At this position, locking tongue 70 does not prevent rotation of tumbler 22. Since protruding member 46 does not engage hole 48, key 26 may now be removed from tumbler 22, as seen in Fig. 6.

It is appreciated that various features of the invention which are, for clarity, described in the contexts of separate embodiments may also be provided in combination in a single embodiment. Conversely, various features of the invention which are, for brevity, described in the context of a single embodiment may also be provided separately or in any suitable subcombination.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the scope of the present invention is defined only by the claims which follow:

C L A I M S

1. Lock apparatus comprising:
 - a lock body having a first elongate bore extending along a first longitudinal axis and a second elongate bore extending along a second longitudinal axis;
 - a tumbler disposed within said first elongate bore and arranged for rotation about said first longitudinal axis, said tumbler being formed with a hole;
 - a locking bolt disposed in said second elongate bore and arranged for sliding motion substantially along said second longitudinal axis into an unlocked orientation; and
 - a tumbler rotation preventer biased against a surface in said lock body and lockingly engageable with said tumbler, said tumbler rotation preventer comprising a protruding member, such that in said unlocked orientation said protruding member is lockingly engaged with said hole.
2. Lock apparatus according to claim 1 wherein if said locking bolt is not in said unlocked orientation, a portion of said locking bolt is biased against said tumbler rotation preventer, thereby moving said tumbler rotation preventer out of locking engagement with said tumbler.
3. Lock apparatus according to either of claims 1 and 2 and wherein said tumbler is rotatable by means of a key inserted therein, and said key cannot be removed from said tumbler when said tumbler rotation preventer is lockingly engaged with said tumbler.
4. Lock apparatus according to claim 3 and further comprising:

a plurality of body pin assemblies disposed in a plurality of body pin bores located within said lock body and communicating with said first elongate bore;

a plurality of tumbler pin assemblies disposed in a plurality of tumbler pin bores located within said tumbler and communicating with said first elongate bore, said plurality of tumbler pin assemblies being arranged such that upon suitable rotation of said tumbler in said first elongate bore, each of said tumbler pin assemblies is aligned coaxially with a corresponding one of said body pin assemblies,

said key being removable from said tumbler only when each of said tumbler pin assemblies is aligned coaxially with a corresponding one of said body pin assemblies, and said tumbler rotation preventer lockingly engages said tumbler at a rotational orientation thereof such that each of said tumbler pin assemblies is not aligned coaxially with a corresponding one of said body pin assemblies.

5. Lock apparatus according to any of the preceding claims wherein said tumbler rotation preventer comprises an end adapted to be biased against a portion of said locking bolt, said end being complementarily shaped to fit a shape of said portion of said locking bolt.

AMENDED CLAIMS

[received by the International Bureau on 4 February 1998 (04.02.98);
original claims 1-5 replaced by new claims 1-5 (3 pages)]

1. Lock apparatus (10) comprising:

a lock body (12) having a first elongate bore (14) extending along a first longitudinal axis (16) and a second elongate bore (18) extending along a second longitudinal axis (20);

a tumbler (22) disposed within said first elongate bore (14) and arranged for rotation about said first longitudinal axis (16), said tumbler (22) being formed with a hole (48);

a locking bolt (28) disposed in said second elongate bore (18) and arranged for sliding motion substantially along said second longitudinal axis (20) into an unlocked orientation; and

a tumbler rotation preventer (40) lockingly engageable with said tumbler (22), said tumbler rotation preventer (40) comprising a protruding member (46), said tumbler rotation preventer (40) being urged by a biasing device (44) in a first direction generally transverse to said first longitudinal axis (16) such that in said unlocked orientation said protruding member (46) is urged to be lockingly engaged with said hole (48);

and wherein if said locking bolt (28) is not in said unlocked orientation, a portion of said locking bolt (28) contacts a portion (50) of said tumbler rotation preventer (40) and urges said tumbler rotation preventer (40) in a second direction generally opposite to said first direction, thereby moving said tumbler rotation preventer (40) out of locking engagement with said tumbler (22).

AMENDED SHEET (ARTICLE 19)

2. Lock apparatus (10) according to claim 1 and wherein said tumbler (22) is rotatable by means of a key (26) inserted therein, and said key (26) cannot be removed from said tumbler
5 (22) when said tumbler rotation preventer (40) is lockingly engaged with said tumbler (22).

3. Lock apparatus (10) according to claim 2 and further comprising:

10 a plurality of body pin assemblies (52) disposed in a plurality of body pin bores (54) located within said lock body (12) and communicating with said first elongate bore (14);

a plurality of tumbler pin assemblies (56) disposed in a plurality of tumbler pin bores (58) located within said
15 tumbler (22) and communicating with said first elongate bore (14), said plurality of tumbler pin assemblies (56) being arranged such that upon suitable rotation of said tumbler (22) in said first elongate bore (14), each of said tumbler pin assemblies (56) is aligned coaxially with a corresponding one
20 of said body pin assemblies (52),

said key (26) being removable from said tumbler (22) only when each of said tumbler pin assemblies (56) is aligned coaxially with a corresponding one of said body pin assemblies (52), and said tumbler rotation preventer (40) lockingly
25 engages said tumbler (22) at a rotational orientation thereof such that each of said tumbler pin assemblies (56) is not aligned coaxially with a corresponding one of said body pin assemblies (52).

AMENDED SHEET (ARTICLE 19)

4. Lock apparatus (10) according to any of claims 1-3 and wherein said portion (50) of said tumbler rotation preventer (40) which is contactable with said locking bolt (28) comprises an end complementarily shaped to fit a shape of said
5 portion of said locking bolt (28).

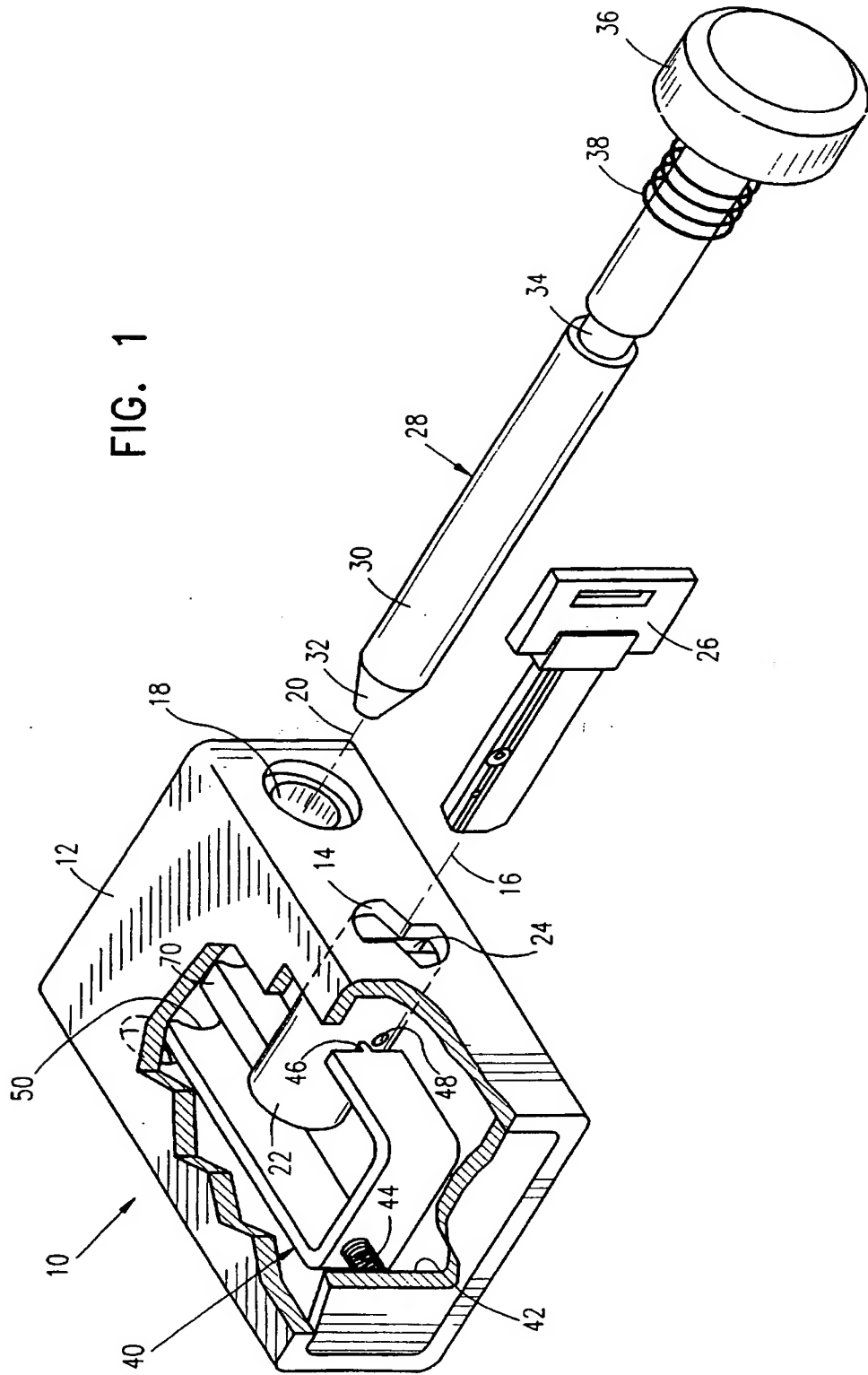
5. Lock apparatus (10) according to any of claims 1-3 and further comprising a locking tongue (70) which is arranged for selectable locking engagement with said locking bolt (28),
10 said locking tongue (70) being actuated by rotation of said tumbler (22), and wherein said locking bolt (28) comprises a shank (30) formed with a notch (34),

and wherein when said locking bolt (28) is not in said unlocked orientation, such that a portion of said locking
15 bolt (28) contacts a portion of said tumbler rotation preventer (40) and urges said tumbler rotation preventer (40) in a second direction generally opposite to said first direction, thereby moving said tumbler rotation preventer (40) out of locking engagement with said tumbler (22),

20 if said locking tongue (70) contacts said shank (30) then said locking tongue (70) substantially prevents rotation of said tumbler (22), and if said locking tongue (70) contacts said notch (34) then said locking tongue (70) does not prevent rotation of said tumbler (22).

1/5

FIG. 1



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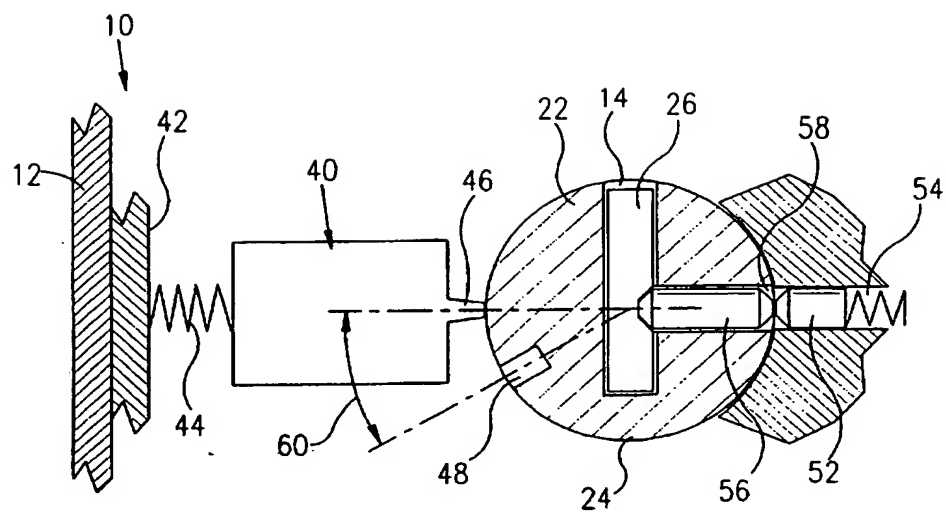


FIG. 2

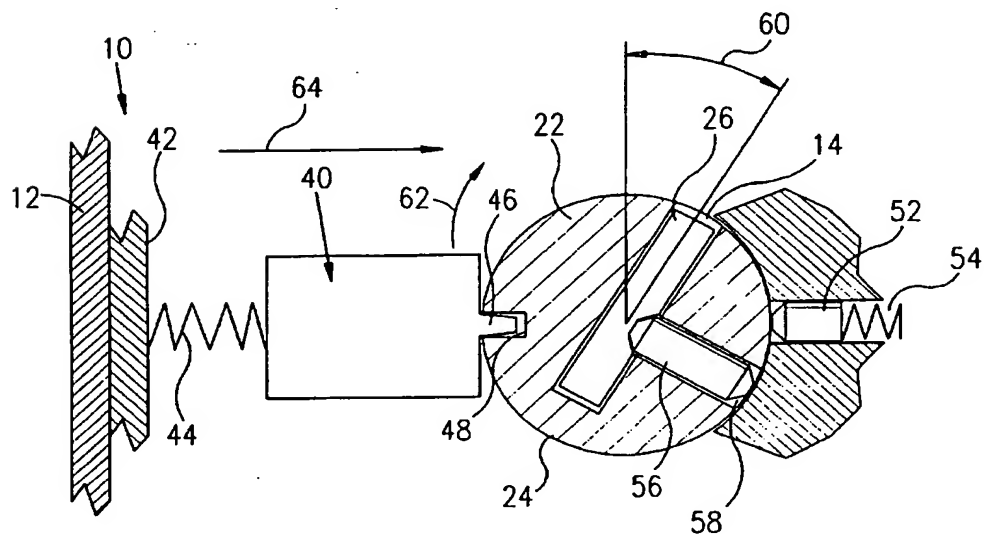


FIG. 3

FIG. 4

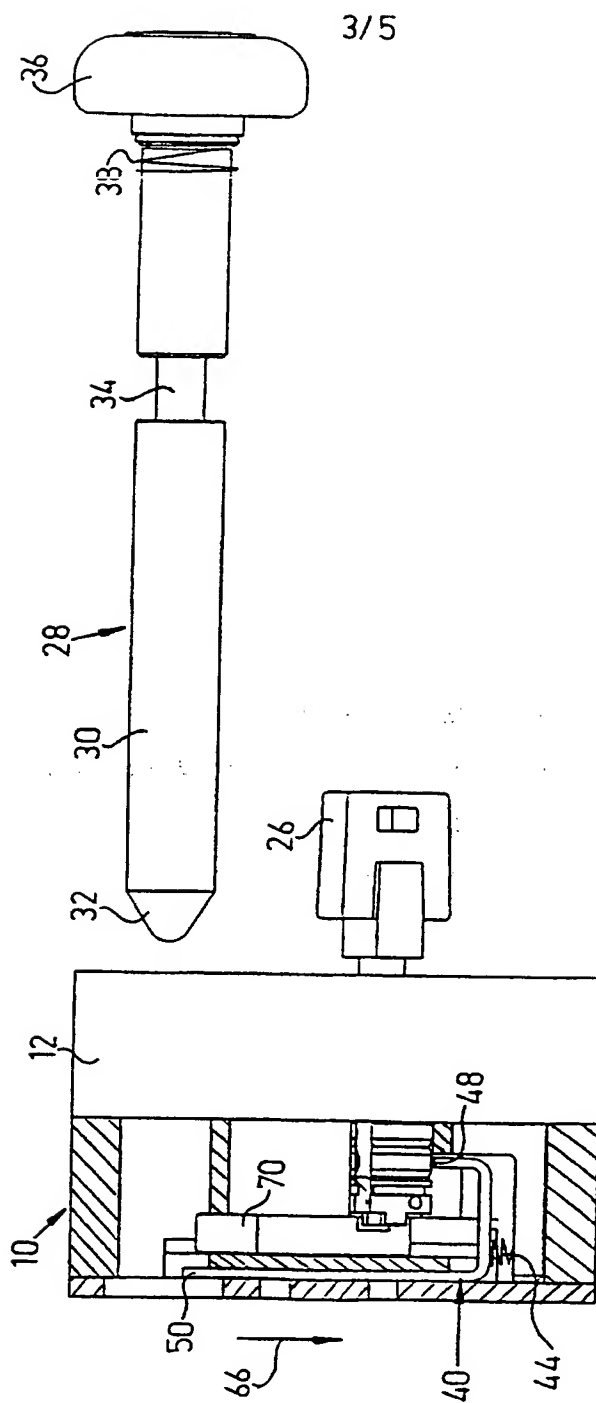
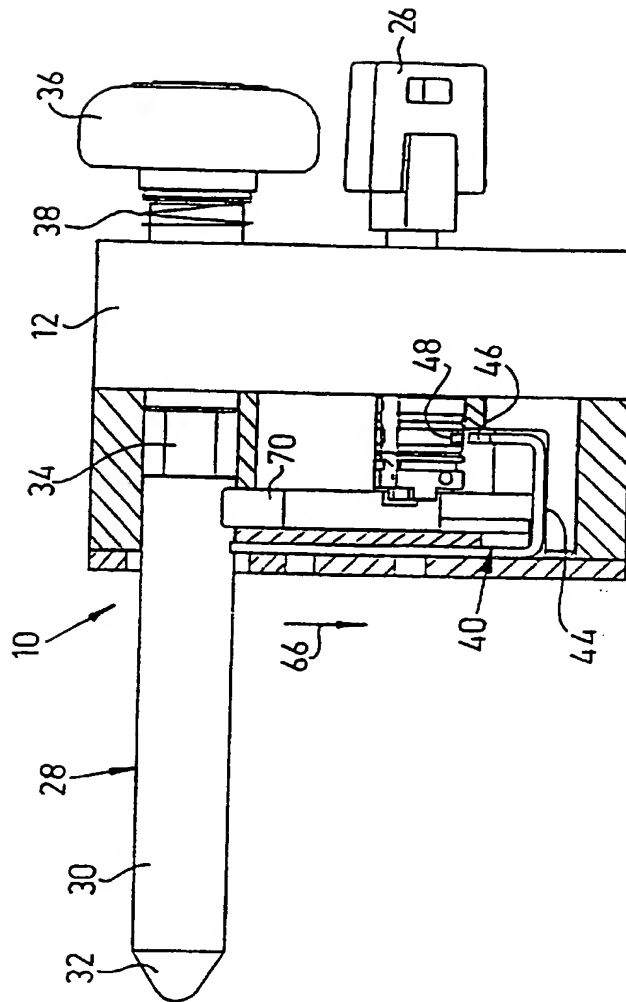
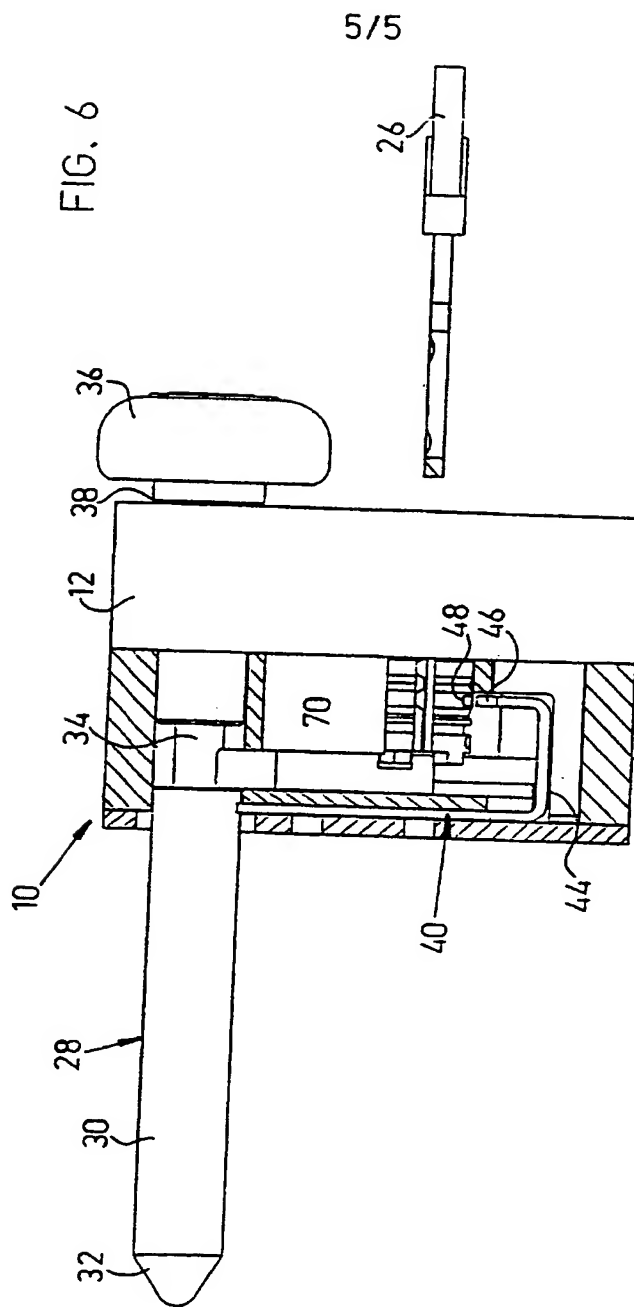


FIG. 5





INTERNATIONAL SEARCH REPORT

 International application No.
PCT/IL97/00269

A. CLASSIFICATION OF SUBJECT MATTER IPC(6) : E05B 11/00 US CL : 70/33,389 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 70/33,389,390 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1,076,587 A (LAPIDUS) 21 October 1913 (21/10/13), see figure 2.	1,3/1
X	US 1,239,244 A (WYCKOFF) 04 September 1917 (04/09/17), see figure 6.	1-3
Y		4
Y	GB 639,171 B (MANTSAS) 21 June 1950 (21/06/50), see fig. 3.	4
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
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Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230		Authorized officer LLOYD A. GALL Telephone No. (703) 308-0828

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL97/00269

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 5
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

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